Cost of Producing CELERY in Hawaii

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SUMMARY

1. Between 1950 and 1962, the State's harvested acreage of celery rose from 20 to 50; yield per acre increased from 25,000 pounds to 48,000 pounds and total annual production rose from 500,000 pounds to 2,400,000 pounds.

2. Celery is grown locally in small plantings. In April 1963 no farm had more than 2 acres of celery; most (of the 15 with celery) had less than 1 acre.

3. Hawaii's share of the Honolulu market for celery rose from 8.2 percent in 1950 to 67.5 percent in 1962, while total annual deliveries to this market rose from 2.3 million pounds to 3.1 million pounds.

4. In April 1963 the price of celery (crated and delivered to retailers) in Honolulu at $6.85 was just about double the corresponding Los Angeles price of $3.35. This is a typical situation.

5. Celery grown in California and in Hawaii had the same price in the Honolulu market in April 1963 but the local grower received $4.75 per crate (after marketing charges), while his California competitor received only $2.55 per crate.

6. Celery is grown locally with relatively high expenses in labor and materials. A typical cost of producing and marketing, up to the retail stage, 41,000 pounds of celery (spoilage 1,000 pounds) is $3,750 per acre, or $5.15 per crate. Production costs amounted to $2,228 per acre and marketing costs were $1,522 per acre.

7. Materials (fertilizers, fumigants, herbicides, crates, etc.) at $1,065 per acre amounted to almost half the total production costs.

8. Labor at $668 per acre (668 hours) is the most important single item of expense.

9. Local celery growers need to harvest about 2 acres more each month to completely supply the island market.

10. This expansion can be achieved, economically, if farmers change some existing practices.

11. Changes recommended include: cooperative handling and packing, after vacuum cooling; a rotational pattern of planting; the mechanization of transplanting and of harvesting; and closer integration of production with marketing requirements.

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Cost of Producing Celery in Hawaii

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INTRODUCTION

Celery growing in Hawaii is not a major enterprise. Its value to farmers in 1962 was only $200,000. Celery is grown on 15 small vegetable farms in the Kamuela district on the island of Hawaii. They now supply two-thirds of the State's annual celery consumption. But the economic analysis of Hawaii celery production which follows has relevance also to other kinds of vegetables grown in Hawaii. State legislators, agriculturists, and others interested in local agriculture have recently become more aware of the competitive difficulties facing island vegetable farmers. These difficulties relate to the small size of many of the vegetable farms in Hawaii, the limited Honolulu "pocket market," the need to import a large proportion of inputs used in producing vegetables (thus incurring relatively high freight charges), competition with large California farms, and production problems associated with a semitropical climate.

Local celery growers have captured a major share of the island market within recent years. How they have done this and what needs to be done if their share is to increase are discussed in this report. It presents findings of a survey carried out in March and April, 1963, to determine the cost of producing celery in Hawaii. This study is one of a series dealing with costs of producing crops and livestock products in the Islands.

SOME ECONOMIC FEATURES OF CELERY PRODUCTION IN HAWAII

Table 1 shows the area, yield per acre, and total annual production of celery in the major growing islands, and for the State as a whole, between 1950 and 1962. During this 13-year period the State's harvested acreage of celery rose from 20 in 1950 (only 10 in 1951 and 1952) to 50 in 1962. The 1962 figure was 10 acres below the peak acreage of 60 acres for 1955-57.

During this 13-year period two significant shifts occurred in the location of celery growing. During 1954 through 1957 Oahu became the major celery producer with Hawaii in second place and Maui in third place. In 1959 the island of Hawaii regained the lead it previously had in celery acreage during 1950-53, and by 1961 it was the only island in the state growing celery. Celery on Hawaii is grown in the Kamuela (North Hawaii) district, an area which is relatively well suited for celery growing. The halt to celery growing on Oahu was caused by the loss of farm leases in the small area on the island reasonably well suited to celery growing.

The trend in yield per acre has been noticeably upwards, roughly doubling between 1950 and 1962. The average State yield went from 25,000 pounds (1950) to 48,000 pounds (1962) per acre. This upward movement was not, however, steady from year-to-year because of variations in weather and incidence of disease.

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Table 1. Acreage, average yield per acre, and total annual production of celery on Hawaii, Maui, and Oahu, 1950-62

	Acreage harvested				Average yield per acre				Total production			
	Hawaii	Maui	Oahu	State[1/]	Hawaii	Maui	Oahu	State	Hawaii	Maui	Oahu	State[1/]
	Acres			Acres	1,000 pounds			1,000 pounds	1,000 pounds			1,000 pounds
1950	14	1	2	20	30.4	25.0	25.0	25.0	425	25	50	500
1951	11	1	2	10	28.2	20.0	17.5	40.0	310	20	35	400
1952	4	1	1	10	31.2	20.0	25.0	20.0	125	20	25	200
1953	7	2	8	20	30.7	20.0	35.0	25.0	215	40	280	500
1954	8	4	36	50	28.1	28.8	24.6	24.0	225	115	885	1,200
1955	10	7	39	60	32.5	28.6	31.5	30.0	325	200	1,230	1,800
1956	14	5	37	60	19.6	25.0	23.6	21.7	275	125	875	1,300
1957	10	4	42	60	25.5	30.0	31.0	28.3	255	120	1,300	1,700
1958	10	3	16	30	32.5	28.3	41.9	36.7	325	85	670	1,100
1959	25	3	0	30	42.2	28.3	0	36.7	1,055	85	0	1,100
1960	40	1	0	40	43.6	30.0	0	45.0	1,745	30	0	1,800
1961	40	0	0	40	50.0	0	0	50.0	2,000	0	0	2,000
1962	50	0	0	50	48.0	0	0	48.0	2,400	0	0	2,400

1/ Due to rounding figures do not add to State total.

Source: Statistics of Hawaiian Agriculture (annual), Hawaii Cooperative Crop and Livestock Reporting Service, cooperating with United States Department of Agriculture, Agricultural Marketing Service.

The rise in celery yield has resulted from the shift in location of celery production to what is probably its best known location in the State, from improved levels of management, and especially from the use of improved technology (less noticeable in labor use). Nakagawa has reported that "the increase in production was made possible primarily through the work of a few progressive farmers who solved, through several costly trial plantings, numerous production problems. This was done by adopting the latest celery varieties for propagation, and by putting to use cultural methods best suited for the crop. The chief obstacle to island-grown celery in the past has been the consumer's resistance to it because of the dark green color and strong flavor. Today, properly grown island celery cannot be differentiated from mainland celery either by color or flavor."[2/]

Total annual production of celery in Hawaii increased fivefold between 1950 and 1962, from 500,000 pounds to 2,400,000 pounds.

Area of land in celery at any one time varied between 11 and 20 acres in the 12-month period ending March 31, 1963, averaging 16 acres. The crop takes 50 to 70 days to grow from seed to transplanting stage, and another 90 to 110 days to the harvest stage. Consequently, to ensure a regular monthly supply of celery, about 4 acres are harvested each month and 1 acre planted each week. Yield per acre varies with the season, dropping in winter and rising to peaks in early summer and early fall.

Farmers plant relatively small areas of celery weekly or biweekly in "beds" of from 1/20 to 1/10 of an acre. They work these areas intensively with family labor and sometimes a little hired help. Table 2 shows the size distribution of celery plantings per farm (under cultivation or being harvested) in Kamuela on March 30, 1963.

Table 2. Size distribution of celery plantings on Hawaiian vegetable farms, March 30, 1963

Size of plot	Number of farms	Area in celery
Acres		Acres
Less than ½	1	0.40
½ - 1	10	7.30
1 - 2	4	5.55
Total	15	13.25

Source: Hawaii Crop and Livestock Reporting Service, cooperating with the United States Department of Agriculture.

The table shows that no farm had more than 2 acres of celery in April 1963 while two-thirds (10) had 1 acre or less of celery. This small scale of operation (and the division of each acre into 10 or as many as 20 celery "beds") contrasts markedly with production conditions on competing California farms.

2/ Yukio Nakagawa, Growing Celery in Hawaii, Hawaii Agricultural Extension Service, University of Hawaii, Circular 373, April, 1957, p. 3.

Table 3. Supply of celery delivered to the Honolulu market from the U. S. Mainland and Hawaii, 1950-62

Year	Hawaii deliveries	U.S. Mainland deliveries	Total deliveries	Hawaii Percent of total
		1,000 pounds		
1950	186	2,093	2,279	8.2
1952	37	2,031	2,068	1.8
1954	886	2,195	3,081	28.8
1956	892	2,544	3,436	26.0
1958	820	2,374	3,194	25.7
1960	1,504	1,728	3,232	46.5
1962	2,102	1,013	3,115	67.5

Sources: Hawaii Crop and Livestock Reporting Service. Federal-State Market News Service, State Department of Agriculture.

Table 3 indicates the deliveries of celery to the metropolitan Honolulu market from the U. S. Mainland and from local sources during the period 1950-62. It shows that local deliveries rose from 186,000 pounds in 1950 (8.2 percent of all deliveries) to 2,102,000 pounds in 1962 (67.5 percent of all deliveries). Shipments of celery from the U. S. Mainland in this 13-year period dropped from 2,093,000 pounds in 1950 to 1,013,000 pounds in 1962, or from 91.8 percent to 32.5 percent of a rising total of deliveries (up 36 percent).

The seasonal pattern of marketing celery in metropolitan Honolulu from the U. S. Mainland and from the island of Hawaii is illustrated in figure 1 for the period 1961-62. This figure shows clearly how shipments from the U. S. Mainland complement local supplies to ensure adequate market supplies in Honolulu. Such relative stability in supplies are a major factor contributing to the steadiness of wholesale prices for celery in the Honolulu market.

Less celery is eaten per capita in Hawaii than on the U. S. Mainland. The relevant figures for these two regions were 6.6 pounds and 8.8 pounds in 1955, and 5.5 pounds and 8.4 pounds in 1961. The lower figure for Hawaii in 1961 may not indicate a downward trend in celery consumption. It is clear, however, that significantly less celery is eaten per capita in Hawaii. Celery prices are undoubtedly closely connected with this situation.

Figure 2 compares typical cost structures of celery (crated, 55 pounds, net) delivered to retailers at Los Angeles and Honolulu in April 1963. This comparison (in April) provides substantially the same findings at other months of the year, too. Several striking facts are revealed by this comparison. Prices of celery (crated and delivered to retailers) in Honolulu, in April 1963, were just about

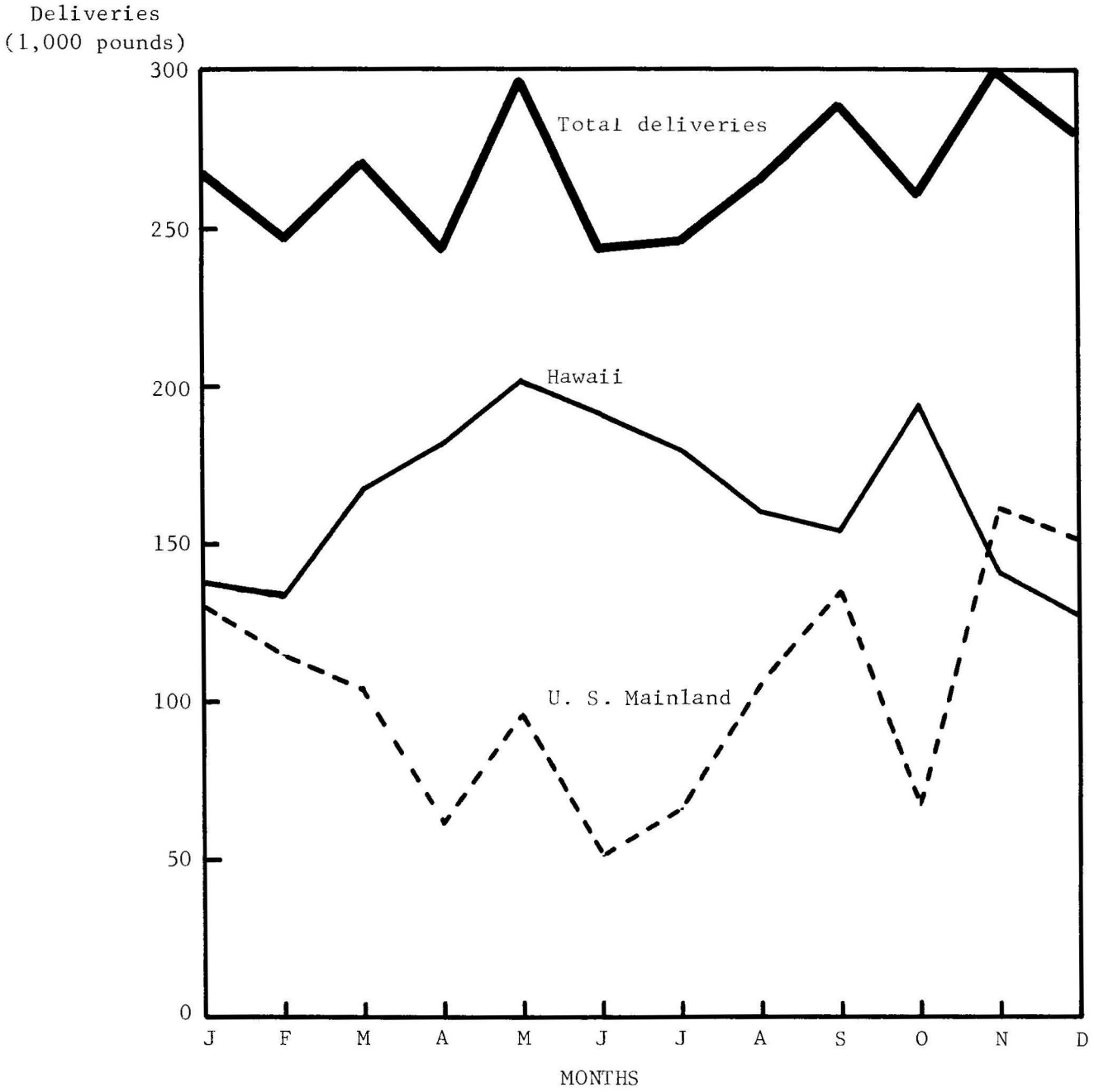

Figure 1. Average monthly deliveries of celery to Honolulu from the U. S. Mainland, and the island of Hawaii, 1961-62.

Sources: Hawaii Crop and Livestock Reporting Service. Federal-State Market News Service, State Department of Agriculture.

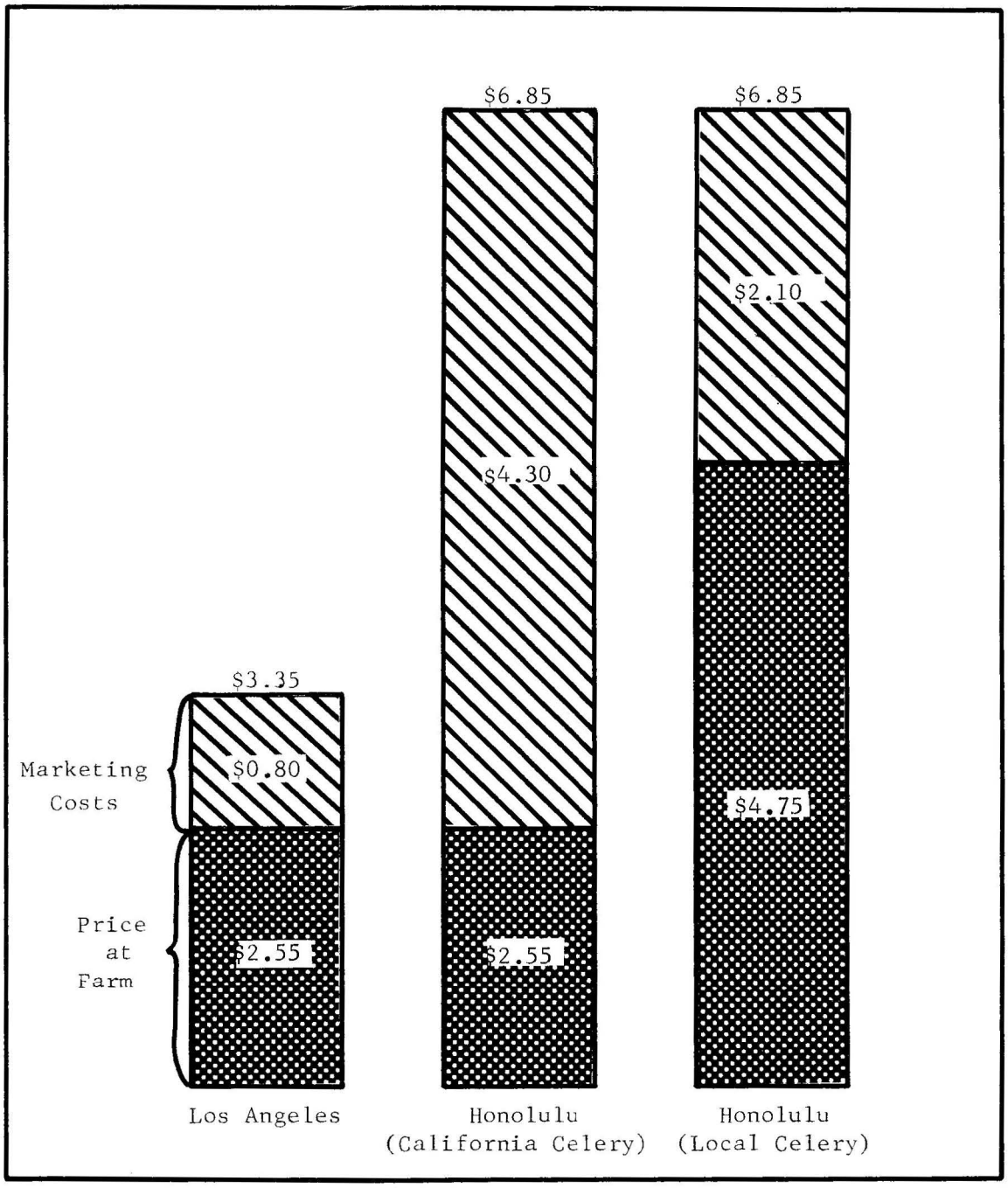

Figure 2. Typical cost structure of celery (crated, 55 pounds, net), delivered to retailers, at Los Angeles and Honolulu, April, 1963.

Source: Federal-State Market News, United States Department of Agriculture, Agricultural Marketing Service.

double ($6.85) the corresponding Los Angeles price ($3.35). The main cause of this wide difference in price is the higher marketing charges (mostly freight) involved in shipping celery from Los Angeles for sale in Honolulu. As Hawaii is a deficit celery-producing state throughout the year, the Honolulu price of celery is basically determined by the Los Angeles price plus shipping and handling costs to Honolulu. Celery grown in California and in Hawaii received the same price in the Honolulu market ($6.85 per crate), but the local grower received $4.75 per crate while his California competitor received only $2.55 per crate (or about half the price received by the Hawaii celery grower). Another fact indicated in figure 2 is that marketing costs on locally grown celery at $2.10 per crate were more than 2½ times above corresponding charges (80 cents per crate) for California farmers. This wide discrepancy in marketing costs is largely explained by extra costs associated with interisland freight as compared with mainland truck freight (in large volume), unnecessary duplication of handling in the local market, and the small scale of business of local wholesalers (cases of celery / 55 pounds, net / are often "broken" into smaller "lots" for sale to small stores and institutions--not a common practice in mainland wholesaling).

The high returns of island celery growers shown in figure 2 are matched by high production costs, as the analysis which follows shows.

COST OF PRODUCTION

Typical production and marketing costs of locally grown celery up to the Honolulu retail stage have been prepared from data collected in a survey of vegetable farms in Kamuela carried out during March and April, 1963. Supplementary information was collected from Hawaii Cooperative Extension Service workers and wholesalers. The costing procedure used is that adopted in similar vegetable cost studies carried out in Hawaii in recent years. Family labor is charged at $1.00 per hour, standard rates are used for power and equipment (see table 4), and other inputs are charged at actual cost. The cultivation and harvesting of celery in the Kamuela district follows a similar pattern on most of the farms. However, variations in costs do arise between one farm and another, primarily from yield differences. Costs per unit vary with the season, too, on the same farm as yield varies. But, costs per acre change much less than costs per unit because a high proportion of production costs, once expended, are sunken costs.

Production costs are grouped under four main headings: labor materials, equipment, and other expenses. Marketing costs comprise freight charges from Kamuela to Honolulu (via ocean barge) and wholesaler's commission for handling the produce. A typical cost of producing and marketing 41,000 pounds of celery (with spoilage of 1,000 pounds) from 1 acre is shown in table 4 to amount to $3,750, or $5.15 per crate (55 pounds, net). Total production costs up to the shipping stage on the island of Hawaii amounted to $2,228 per acre, or $3.05 per crate. Total costs of marketing from the shipping point to the Honolulu retailer amounted to $1,522 per acre ($2.08 per crate).

If the price paid to the wholesaler by the Honolulu retailer had been 13 cents per pound, or $7.15 per crate (55 pounds, net)--a typical figure--the farmer would have cleared a good profit of $1,470 per acre. But such good returns are often followed by poor profits or even losses, as an attack by Sclerotinia (watery soft rot) fungus, for example, may lead to a quick deterioration in crated celery en route to Honolulu. Local growers rely upon celery to provide them with a "fair return"--at least a dollar an hour for their labor. The crop is unlikely to give them a windfall in profits by "catching the market right," however. Mainland imports of celery see to that!

Table 4. Typical cost of producing and marketing 1 acre of celery (yield of 41,000 pounds, spoilage 1,000 pounds) and 1 crate of celery (55 pounds, net), Kamuela district, Hawaii, January-April, 1963 (for Honolulu market)

Item	Unit	Unit cost	Units used	Cost	
				Per acre	Per crate (55 pounds, net)
		Dollars		Dollars	Dollars
Production Costs					
Labor					
Seedling bed preparation and maintenance	Hour	1.00	24	24.00	
Field preparation and planting	Hour	1.00	148	148.00	
Growing operations	Hour	1.00	248	248.00	
Harvesting	Hour	1.00	210	210.00	
Shipping to local depot	Hour	1.00	38	38.00	
Total				668.00	.91
Materials					
Fertilizer	100 pounds	4.25	44	187.00	
Fumigants	Gallon	2.00	15	30.00	
Herbicides	Pound	3.60	5	18.00	
Insecticides	Pound	.55	112	61.60	
Fungicides	Pound	1.10	36	39.60	
Seeds	Ounce	1.25	6	7.50	
Water	Acre-inch	9.20	11	101.20	
Crates	One	.85	730	620.50	
Total				1,065.40	1.46
Equipment					
Tractor	Hour	1.25	76	95.00	
Truck	Hour	3.00	30	90.00	
Power spray	Hour	.80	60	48.00	
Cultivation	Hour	.70	16	11.20	
Irrigation	Month	2.00	4	8.00	
Total				252.20	.35
Other expenses					
Rent	Acre	15.00	1	15.00	
Taxes				192.00	
Sundries				35.00	
Total				242.00	.33
Total production costs				2,227.60	3.05
Marketing Costs					
Freight to Honolulu				481.80	
Wholesaler's commission				1,040.00	
Total marketing costs				1,521.80	2.08
TOTAL COSTS				3,749.40	5.13

Table 4 shows that labor amounting to $668 per acre, or 30 percent of total production costs, was the most important single item of production expenses. A total of 172 hours was typically spent on field operations (including care of the seedling bed) up to the stage where celery plants had been transplanted. Time taken to dig out plants from the seedling bed and to transplant amounted to 124 hours. All transplanting was done by hand. Growing operations, which took a combined total of 248 hours, comprised spraying (140 hours), irrigation (40 hours), hoe weeding (37 hours), fertilizing (6 hours), and off-field work (25 hours). The heavy labor inputs involved in planting and growing celery in Kamuela contrast sharply with celery-growing practices in such important states as Utah, Florida, and California, where the range is typically between 120 and 160 hours for these operations.

Harvesting took 210 hours for a 730-crate crop, or just about 3½ crates per hour. The rate of harvesting varies from 2½ to 4½ crates per hour, depending upon the skill of the workers and the size of the celery heads. Large heads mean fewer heads per crate and hence a faster rate of harvesting--and vice versa. The celery is cut by hand (with a knife), placed in a container, and then washed and trimmed in the field before it is crated--also in the field. Time taken to ship the crates to the local depot or collection center in Kamuela naturally varies with location of the farm--38 hours is taken as typical.

Table 4 shows that local celery growing requires a heavy expenditure on materials. All are imported except for water. Total cost of material is given at $1,065.40 per crate, or $1.46 per crate (48 percent of total production costs). These figures do not include gas, oil, and other costs of operating equipment. Crates at $620.50 per acre were the most important single item. At 85 cents apiece, celery crates in Kamuela are just double their cost to the California farmer--freight charges explain this wide difference. Fertilizer at $187 per acre (applied in heavy amounts, in this instance, 4,400 pounds) is the next most costly material, followed by water ($101.20), insecticides ($61.60), fungicides ($39.60), fumigants ($30), herbicdes ($18), and seeds ($7.50).

Celery growing is an expensive business at Kamuela, as these cost figures indicate. Not only are such materials as fertilizer, insecticides, and fungicides considerably more costly per unit than on the U. S. Mainland but also heavier applications are required under Hawaii conditions.

Equipment costs at $252.20 per acre, or 35 cents per crate (11 percent of total production costs), included 76 hours of tractor use, 30 truck hours, 60 hours of power spraying, 16 hours use of cultivation equipment, and 4 months use of irrigation equipment.

Rent was charged at $15 per acre for the period the celery crop was in the ground. Taxes at $192 and sundries at $35, per acre, complete the cost structure to the collection center at Kamuela.

Freight costs of moving the celery to Honolulu harbor averaged $481.80 for a 40,000-pound crop, or 66 cents per crate. Wholesaler's commission in Honolulu was typically 20 percent of the price received from the retailer, or as table 4 shows, $1,040 per acre, or $1.42 per crate.

HOW LOCAL FARMERS CAN CAPTURE THE ISLAND MARKET AND LOWER PRODUCTION COSTS

The preceding analysis of production costs of local celery growers, together with the data given in figure 2, should make it clear that such costs are very high. Hawaii's relatively small population consumes only 75 to 80 acres of celery

annually--or about 6 acres monthly. This fact is basic to any discussion of methods to improve the competitive position of local celery growers (and other vegetable growers, too). Another basic fact is that to grow celery most inputs have to be shipped in and this involves relatively heavy freight charges (on goods with a low value per unit of weight). Thus, (1) large-scale methods of production involving heavy machinery (as in pineapple and sugar production) are not practicable or economical, and (2) local celery production depends for its existence upon the protective barrier provided by the ocean freight rate on celery shipped from California.

In spite of these problems, however, island farmers have recently sharply increased their share of the local celery market. Is it possible for them to supply the entire market and to cut their costs while doing so?

The answer to these connected questions is a qualified "yes."

Supplies of land and water, two limiting factors until recently in Kamuela, are now sufficiently expanded by the State's land development in Lalamilo. Water is becoming available in more reliable flows at 9 cents per 1,000 gallons in Lalamilo compared with the high rate of 35 cents per 1,000 gallons on the older, established farm in Kamuela. Improved interisland freight services are likely to reduce the costs of materials used in celery (and other vegetable) production.

Cooperative handling and packing of celery is also likely to result in a significant lowering of costs and some improvement in crop quality. This would come about with the establishment of a vacuum cooling plant in Kamuela together with modern packing facilities.[3/] Savings in the shift from wooden wirebound containers to fiberboard containers alone, which would result from this improvement, are estimated to amount to about $300 per acre on an average celery crop. Cooperative handling would sharply cut down harvesting time in the field and possibly enable this operation to be handled mechanically, and at a faster rate.

Economy in use of labor and equipment could be greatly increased, and costs lowered, if some cooperative planting agreement were made between Kamuela celery growers. Celery is grown, at present, on many very small beds. Only 4 acres are harvested monthly altogether, but this may consist of as many as 100 beds of between 1/10 acre and 1/25, or less, of an acre. So much duplication involves costly methods of operation. A rotational system of cooperative planting coordinated with marketing requirements would surely enable some important economies to be made. Machines could be developed without much difficulty to transplant the celery and to harvest it. These machines need not, of course, handle only celery. They should be adaptable to requirements of several vegetable crops.

By closer integration of production with marketing, the cooperative use of marketing equipment, an agreement to plant larger areas in rotation, and the introduction of machines (specially designed locally for small farms) to plant and harvest celery, costs of producing and marketing celery could, undoubtedly, be significantly lowered. These developments will eventually come but competition alone will not bring them about. Directed effort is needed to achieve the potential economies implied.

3/ Jack Ishida and Masaru Sumida, Economic Feasibility of the Establishment of a Vacuum Cooling Plant in Kamuela, Hawaii Cooperative Extension Service, University of Hawaii, March, 1963, 7 pp.

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